Technical Memorandum on Energy Impacts

for the

Highway 1 Soquel to Morrissey Auxiliary Lanes Project

05-SCR-1, PM 14.96/15.94
EA 05-0F650K

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1. Introduction

This memorandum discusses energy impacts for the Highway 1 Soquel to Morrissey Auxiliary Lanes Project. Because the proposed project has no potential for substantial energy impacts, in accordance with Caltrans' Standard Environmental Reference Guidelines, only a qualitative energy analysis was conducted.[1]

The energy impacts of transportation projects are typically divided into two components: (1) the direct energy required for ongoing operations (in this case, the use of petroleum-based fuels and alternative fuels for motor vehicle travel within the project area) and (2) the indirect energy required to produce the materials for and carry out construction of the project. In the long term, the direct, or operating, energy requirements are usually greater and of primary importance. This discussion, therefore, focuses on the direct energy requirements for ongoing Highway 101 operations with and without the proposed project.

2. Project Description

The proposed project extends for a distance of less than one mile (0.98 miles/1.57 kilometers) from the southbound Soquel Avenue off-ramp to the northbound Morrissey Boulevard on-ramp (post mile 14.96/kilometer post 24.08 to post mile 15.94/kilometer post 25.65) in the City of Santa Cruz, Santa Cruz County, California. A map of the project vicinity and location is included below in Figure 1.

Project Purpose

The purpose of the Soquel to Morrissey Auxiliary Lanes Project is to improve traffic conditions for weaving and merging movements on Highway 1 between Soquel Avenue and Morrissey Boulevard. Meeting this overall purpose also would address the following purposes:

- Improve traffic flow by reducing mainline and ramp congestion caused by impeded merging and weaving movements;

- Eliminate the southbound lane drop required to conform to the existing four-lane roadway section at the La Fonda Avenue Overcrossing when the State Route 1/State Route 17 Merge Lanes Project is completed;

- Improve pedestrian and bicycle access and safety.

Project Need

Identified needs include recurrent congestion from impeded weaving and merging movements, queuing traffic from the southbound bottleneck at the La Fonda Avenue Overcrossing, and limited pedestrian and bicycle access crossing Highway 1 in the project area.

[1] Source: http://www.dot.ca.gov/ser/vol1/sec3/physical/ch13energy/chap13.htm

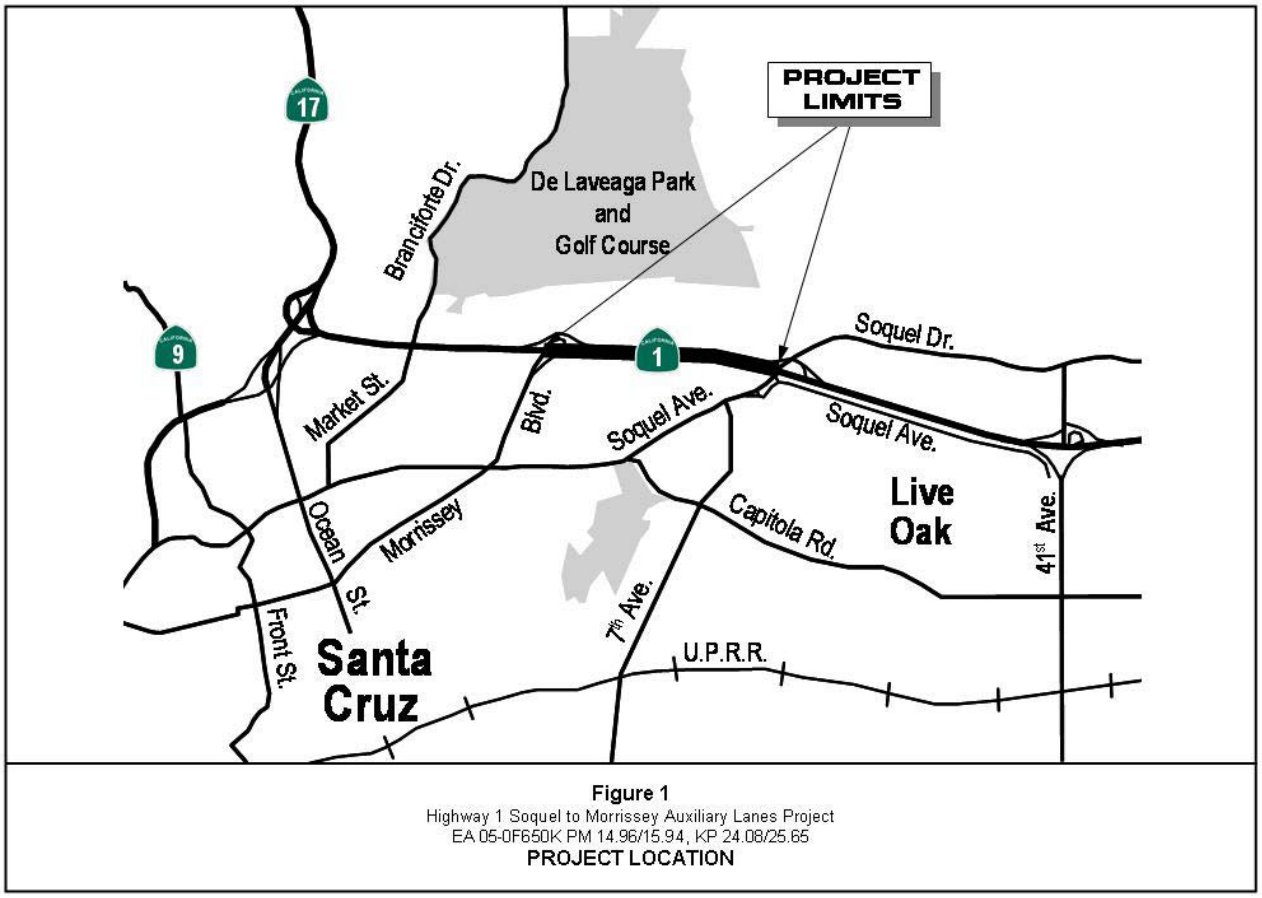

Figure 1
Highway 1 Soquel to Morrissey Auxiliary Lanes Project
EA 05-0F650K PM 14.96/15.94, KP 24.08/25.65
PROJECT LOCATION

Alternatives

Based on preliminary evaluations of a range of operational improvements and in consultation with Santa Cruz County and the City of Santa Cruz, two alternatives remain under consideration: the No-Build Alternative and one Build Alternative.

No-Build Alternative

The No-Build Alternative would not address the project purpose and need but offers a basis for comparison with the Build Alternative. It assumes no major construction on Highway 1 through the project limits other than planned and programmed improvements and continued routine maintenance. The only planned and programmed improvement contained in the 2005 Regional Transportation Plan (RTP) is the State Route 1/ State Route 17 Merge Lanes Project, which is currently under construction with completion anticipated in September 2008Summer 2009 or sooner; it is considered as part of existing conditions for the Soquel to Morrissey Auxiliary Lanes Project. The Highway 1 HOV Lane Widening Project is also planned, but is not included in the No-Build Alternative, as it is not yet programmed and will not be completed by the 2015 opening year for the Soquel/Morrissey Auxiliary Lanes Project.

Build Alternative

The Build Alternative would add one 12-foot wide (3.7-meter) auxiliary lane from the Soquel Avenue on-ramp to the Morrissey Boulevard off-ramp in the northbound direction and extend a12-foot wide (3.7-meter) lane between La Fonda Avenue and the Soquel Avenue off-ramp in the southbound direction, with 10-foot (3.0-meter) outside shoulders between the Soquel Avenue and Morrissey Boulevard interchanges. An auxiliary lane extends from the on-ramp of one interchange to the off-ramp at the next interchange and is designed to separate traffic movements entering and exiting the freeway from mainline traffic. It is not designed for use by through traffic. The project also would replace the La Fonda Avenue Overcrossing, provide California Highway Patrol (CHP) enforcement areas and install infrastructure for Intelligent Transportation System elements.

A typical auxiliary lane would be constructed northbound from the Soquel Drive on-ramp to the Morrissey Boulevard northbound off-ramp (0.7 miles or 1.1 kilometers). On southbound Highway 1, the new outside lane being constructed with the State Route 1/ State Route 17 Merge Lanes Project would be extended from north of the La Fonda Avenue Overcrossing to the Soquel Avenue exit ramp(0.3 miles or 0.5 kilometers). This lane would be "exit only" at Soquel Avenue, and the widening would eliminate the outside lane-drop north of La Fonda. No changes would be made to the Soquel Avenue or Morrissey Boulevard ramps. Retaining walls are proposed at several locations to reduce the amount of earthwork required, keep the improvements within the existing highway right-of-way and minimize impacts to wetland areas. Soundwalls found to be feasible and reasonable based on current cost estimates also are recommended.

Additionally, the La Fonda Avenue Overcrossing would be replaced and widened to accommodate the proposed auxiliary lanes. The new bridge would provide for two 12-foot (3.7-meter) wide traffic lanes, as well as six-foot (1.8-meter) wide bicycle lanes and five-foot (1.5-meter) wide pedestrian sidewalks in both directions.

The project also would include demolition of the existing La Fonda Avenue Overcrossing and existing roadway shoulder, earthwork and fill, and temporary easements for construction of the overcrossing replacement and a temporary pedestrian/bicycle crossing. Disposal will be in accordance with all applicable regulations at locations to be identified at the final design phase. There is no permanent right-of-way impact anticipated for this alternative. Temporary easements of City of Santa Cruz-owned property would be required.

3. Results of Traffic Analysis and Corresponding Impacts on Energy Consumption

Traffic analysis results that would influence energy consumption in the project area are presented in this section. Information for this section is taken from the Traffic Operations Report (Wilbur Smith, 2007), which presents traffic analysis and results for the proposed project. Even though the project improvements focus on Highway 1 between Soquel Avenue and Morrissey Boulevard (less than a mile long), the proposed traffic improvements would affect traffic operations beyond these limits. Hence, the traffic conditions for Highway 1 between Highway 17 interchange and the San Andreas Road/ Larkin Valley Road Interchange (about 9 miles) are considered in this study.

By year 2015, without capacity improvements to Highway 1, traffic operating conditions on the Highway 1 corridor are expected to deteriorate when compared to the existing conditions. Due to insufficient mainline capacity for the forecast volumes, bottlenecks and queues would develop at certain locations along the mainline. Low travel speeds and long delays would be prevalent during peak hours. Such congested traffic conditions

contribute to inefficient energy consumption as vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds on a congested roadway.

Under Year 2015 No-Build Conditions, the vehicle delay in the northbound direction during the morning peak hour would increase from the existing 14 minutes per vehicle to 40 minutes, an increase of 186 percent. The vehicle delay during the evening peak hour would increase from the existing 15 minutes per vehicle to 34 minutes, a 125 percent increase compared to existing conditions. In general, there would be a 17 to 64 percent decrease in speeds and a 0 to 472 percent increase in delay, depending on the peak hour and direction.

The Auxiliary Lane Alternative would improve weaving and merging movements within the project limits and hence reduce associated congestion and queuing, and thereby improve roadway operations along the study area. By eliminating the lane drop at La Fonda, the proposed project would eliminate a bottleneck at this location. Improved traffic conditions would translate to improved travel speeds and reduction in travel time and delay.

When compared to the No-Build Alternative, there would be an 8 to 264 percent increase in speed and a 75 to 94 percent reduction in delay, under the Auxiliary Lanes Alternative, except in the southbound direction during the evening peak hour. In the southbound direction, during the evening peak hour, there would be a heavy flow of commuters from west of the project limits. This would include commuters returning home from jobs in the South Bay Area. Since the origin of this heavy southbound traffic is outside the project limits, the ramp metering within the project limits would not help to reduce corridor delay; there would even be a slight degradation in corridor travel speeds and delay in the southbound direction during the evening peak hour due to increased traffic throughput in the immediate project area feeding downstream bottlenecks.

Traffic diversions near bottlenecks are common and can cause considerable delay. This increase in diverted traffic would likely increase vehicle miles traveled and deteriorate conditions on local streets, increasing delay and energy consumption. Reduction of bottlenecks under the Auxiliary Lane Alternative would probably decrease traffic diversions to local streets and hence would probably reduce vehicle miles traveled. Energy consumption of vehicles is directly proportional to vehicle miles traveled and hence lower vehicle miles traveled under the Build Alternative translates to energy savings[2].

Under the Auxiliary Lane Alternative, average travel time, vehicle delay, and duration of congestion on Highway 1 would decrease considerably compared to No-Build conditions. Auxiliary Lane Alternative would reduce traffic delay on the Highway 1 mainline. This would result in more efficient energy consumption. Due to all the above mentioned advantages, the long term impacts of the Auxiliary Lane Alternative on transportation and vehicular traffic energy use would generally be positive.

4. Conclusion

The lessening of congestion and related traffic delay is associated with faster and less variable average travel speeds, resulting in more efficient vehicle operation under Auxiliary Lane Alternative when compared to No-Build conditions. Improved operations are likely to reduce vehicle energy use, whether in the form of petroleum fuels or alternative sources of energy.

[2] Energy use in BTUs (British Thermal Units) for any mode of travel such as bus, auto, etc. = Vehicle miles traveled * Total BTUs per vehicle mile (for the type of vehicle, bus, auto, etc.)

For these reasons, the Auxiliary Lane Alternative is anticipated to have a slightly beneficial effect on direct energy use compared to the No-Build Alternative. No energy mitigation measures would be needed.